U.S. Department of Transportation
Federal Aviation Administration

Subject:	INFORMATION: Flutter Substantiation for Fin Tip Modifications for Transport Airplanes	Date:	July 1, 1999
From:	Manager, Transport Airplane Directorate, Aircraft Certification Service, ANM-100	Reply to Attn. of:	99-115-13
To:	SEE DISTRIBUTION LIST		

With the increasing dependence on satellite communications, there is a trend to modify transport airplanes by adding antennas to the vertical stabilizer. These modifications may involve the addition of mass and aerodynamic changes to the fin tip, which could have an adverse effect on the flutter margins.

For a transport airplane, the flutter margins must be maintained irrespective of any ground tests or flight flutter tests that are conducted within the design envelope. The required margins are 15 to 20 percent beyond V_d for the healthy airplane and 15 percent over V_c, or up to V_d , for airplane configurations involving failures and adverse conditions. In many cases the flutter modes with the least margin over the minimums will be adverse conditions or failures such as ice mass on the vertical stabilizer or a free rudder. Even for powered rudder control systems with dual actuators, the control system failure requirements of § 25.671 will likely require the consideration of combined failures to the extent that the rudder must be considered free. Where rudder mass balance is used for flutter prevention, usually just enough mass is used to clear the requirement. The addition of more mass on the fin tip can provide a significant and adverse effect on the critical flutter modes even though it may be difficult to identify any significant change in frequency by a ground vibration test.

The following means are available to the modifier to substantiate the installation:

a. The modifier obtains confirmation from the airplane manufacturer that the mass and aerodynamic changes are within the range of parameter variations already substantiated.

b. The modifier provides a comparison between his installation and another installation that has been properly substantiated and approved and shows that the mass and aerodynamic changes are within the range already substantiated.

c. The modifier submits a comprehensive flutter analysis validated by ground vibration testing and flight flutter testing in accordance with § 25.629.

It is important for both the Federal Aviation Administration (FAA) and the Applicant to agree to a flutter compliance plan early in the program so that the appropriate resources and designees (if required) can be provided for. It is also recommended that the FAA project engineer review the proposed modification for flutter criticality with the Aircraft Certification Office, or foreign civil aviation authority, responsible for overseeing the issuance of the type certificate for the airplane being modified.

Although the focus of this memorandum is on the fin tip modifications, the same concerns and process can be extended to many other modifications to transport airplanes.

If you have any questions regarding this memorandum, contact Jim Haynes at 425-227-2131.

Original signed by John Hickey for
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